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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/893,577 | 06/29/2001 | Masahiro Tadokoro | 501.40201X00 | 5596 |

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| EXAMINER | |
|---|---|
| CHEN, KIN CHAN | |
| ART UNIT | PAPER NUMBER |
| 1765 | 8 |

DATE MAILED: 06/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/893,577 | TADOKORO ET AL. | |
| | Examiner | Art Unit | |
| | Kin-Chan Chen | 1765 | |

*-- Th MAILING DATE of this communication appears on th cover sheet with the correspondenc address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *13 May 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-6 and 8-40* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6 and 8-40* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 7 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

## DETAILED ACTION

### *Priority*

1. A translation of the foreign application submitted under 37 CFR 1.55 has been received and considered. Liu (US 6,403,491) reference as evidence is withdrawn.

### *Claim Rejections - 35 USC § 112*

2. Claims 22-40 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claims 22, 37, 38, 39 and 40, "silicon plug" is new matter. Applicant pointed out pages 66-67 in the specification for the support. However, it is only noted that a plug of doped polysilicon in said paragraphs.

### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-6 and 8-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada et al. (US 6,159,862; hereinafter "Yamada" ).

In reference to claims 1, 9-11, 18-21, Yamada teaches that a silicon nitride insulating film may be deposited on a semiconductor substrate. A silicon oxide insulating film may be deposited on the silicon nitride insulating film (or on a semiconductor substrate). A hard mask may be formed on the silicon oxide insulating film. See col. 7, lines 30-59; Fig. 2. The semiconductor substrate may be subjected to a plasma etching treatment through the hard mask as an etching mask using an etching gas containing $C_5F_8$ (or fluorocarbon), oxygen, and a dilution gas (e.g., Ar) to process the silicon oxide insulating film. During the process, the etching gas has been fed into the treatment chamber and a high-density plasma is excited (so –called plasma density ranges from $1x10^{10}$ to $1x10^{12}$ /$cm^3$ (or $1x10^{13}$ $cm^3$) in instant claims 9, 10, 28, and 29). See col. 8, lines 16.

Yamada does not disclose the residence time of the etching gas that is used in its process. The instant claims differ from Yamada by specifying various residence time of the etching gas (such as 50-700 ms in claims 1 and 22, 50-350 ms in claim 18, 100-200 ms in claim 19). However, it would have been obvious to one of ordinary skilled in the art to determine the suitable residence time through routine experimentation to obtain the best etched product achievable because the skilled artisan understands that the residence time is directly related to the amount of reactive gas dissociation occurring in the plasma, the longer a gas molecule remains exposed to a plasma, the

more likely it is that dissociation of the gas molecule will continue. See evidences in Collins et al. (US 6,238,588 B1), Jeng et al. (US 5,282,925), and Toprac et al. (US 6,238,937) in the record.

In reference to claims 2, 5, 16, 17, 20, and 21, Yamada teaches that the pressure within the etching chamber may be 30 mTorr (col. 11, line 12). The instant claims differ from Yamada by specifying various pressures (or partial pressures of $C_5F_8$ ) within the etching chamber (such as 0.7 to 7 Pa in claims 2 and 20; 1.3 to 4 pa in claims 5 and 21; 0.02 to 0.2 Pa of $C_5F_8$ in claim16; 0.04 to 0.1 pa of $C_5F_8$ in claim 17). Yamada teaches examples of the process variables including pressure (col. 8, lines 1-16), and discloses that the process variables may be changed for different etching results (col. 8, lines 42-47). Since pressure (pressure or partial pressure of each gas) in the chamber is known to be result-effective variable, it would have been obvious to one of ordinary skilled in the art to determine the optimum, operable range in order to produce the best etched product achievable.

In reference to claims 3-6, 12, 13, and 21, Yamada teaches that that total flow rate of the etching gas may be at 780 $cm^3$ / minute (col. 5, line 64), which is within the range cited. The flow rate of dilution gas is larger than the flow rates of the fluorocarbon gas and oxygen (instant claim 6). The instant claim 20 differs from the Yamada by specifying 700 $cm^3$ / minute. Since the flow rate of Yamada is close enough that one skilled in the art would have been expected to have the same properties.

As to claims 14, and 15, Yamada teaches the ratio of the flow rate between the oxygen and $C_5F_8$ (col. 5, line 48).

Yamada teaches that the temperature at the inner wall surface of the chamber may be 60 °C and may be 40 °C at lower electrode. Yamada does not disclose the temperature of the substrate being plasma etched in its process. The instant claims differ from Yamada by specifying the temperature of the substrate, however, the temperature of the substrate is commonly determined by routine experimentation. It would have been obvious to one of ordinary skilled in the art to optimize the temperature through the routine experimentation in order to produce an expected result.

Changes in compositions, temperature, concentrations, or other process conditions of a process do not impart patentability unless the recited ranges are critical ( i.e., they produce a new and unexpected result that differs in kind and not merely in degree from the result of the prior art). *In re Woodruff*, 16USPQ2d 1934,1936 (Fed. Cir.1990); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809; *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

## CRITICALITY OF PROCESSING PARAMETERS

"Where the principal difference between the claimed process and that taught by the reference is a temperature difference, it is incumbent upon applicant to establish criticality of that difference" *Ex parte Khusid*, 174 USPQ 59. This decision is clearly analogous to pressure differences and other process parameters.

***Response to Arguments***

5. Applicant's arguments filed May 13, 2003 have been fully considered but they are not persuasive.

Applicant has argued that the motivation is required for the evidences of Collins et al. (US 6,238,588 B1), Jeng et al. (US 5,282,925), and Toprac et al. (US 6,238,937). As has been stated in the office action, because the skilled artisan understands that the residence time is directly related to the amount of reactive gas dissociation occurring in the plasma, the longer a gas molecule remains exposed to a plasma, the more likely it is that dissociation of the gas molecule will continue. It is a notoriously well-known principle. The above cited references are evidences to show residence time is known result-effective variable and the obviousness to one of ordinary skilled in the art to determine the suitable residence time through routine experimentation to obtain the best etched product achievable.

Applicant has argued that Yamada does not teach the process parameters such as temperature, pressure, flow rate etc. As stated in the office action, "changes in compositions, temperature, concentrations, or other process conditions of a process do not impart patentability unless the recited ranges are critical ( i.e., they produce a new and unexpected result that differs in kind and not merely in degree from the result of the prior art). In the absence of showing criticality or new, unexpected results, it would have been obvious to one of ordinary skilled in the art to determine the suitable said process

parameters through routine experimentation in Yamada in order to produce an expected result.

***Conclusion***

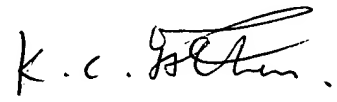
6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Collins et al. (US 6,238,588 B1, col. 2, lines 35-50), Jeng et al. (US 5,282,925, abstract), and Toprac et al. (US 6,238,937; col. 7, lines 25-25) teach controlling or adjusting residence time of etching gas in the etching process.

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (703) 305-

0222. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-2934.



Kin-Chan Chen
Primary Examiner
Art Unit 1765

K-C C
June 9, 2003